

Patent claims

1. A method for cleaning at least one surface (12) of a component (10) using a cleaning device (14), the surface (12) of the component being cleaned by means of a cleaning head (18) which can be moved by a positioning device (16), while forming a contact pressure of the cleaning head (18) on the component (10), characterized in that the positioning device (16) has a rough positioning system (20) and a fine positioning system (22), the cleaning head (18) being moved in a force-controlled manner by means of the fine positioning system (22) in at least one direction of movement (24, 26, 28, 30, 32, 34).
2. The method as claimed in claim 1, characterized in that the contact pressure by means of the fine positioning system (22) is limited with regard to its maximum value.
3. The method as claimed in claim 1 or 2, characterized in that the cleaning head (18) is moved along at least one axis of movement (24, 26, 28) by means of the fine positioning system (22) within a predeterminable tolerance window.
4. The method as claimed in one of the preceding claims, characterized in that the movement of the cleaning head (18) in contiguous contact with the component (10) takes place by means of the fine positioning system (22) alone or by means of simultaneous actuation of the rough positioning system (20) and the fine positioning system (22).
5. The method as claimed in one of the preceding claims, characterized in that, to optimize cleaning, the contact pressure can be variably set.

6. The method as claimed in one of the preceding claims, characterized in that the contact pressure is predetermined in dependence on an active contact surface of the cleaning head (18) of varying size and/or in dependence on a parameter of the component.
7. The method as claimed in one of the preceding claims, characterized in that the changing of the contact pressure on the fine positioning system (22) take places in an automated or manual manner before and/or during the cleaning operation.
8. The method as claimed in one of the preceding claims, characterized in that the cleaning head (18) is moved manually by means of a manipulator as the positioning device (16) or in an automated manner by means of a robot (36) as the positioning device (16).
9. A cleaning device, in particular for implementing the method as claimed in one of the preceding claims, the cleaning device (14) serving for cleaning at least one surface (12) of a component (10) and having a cleaning head (18) which can be moved by means of a positioning device (16), characterized in that the positioning device (16) has a rough positioning system (20) and a fine positioning system (22), the movement of the cleaning head (18) being force-controlled by means of the fine positioning system (22) at least in one direction of movement (24, 26, 28, 30, 32, 34).
10. The cleaning device as claimed in claim 9, characterized in that the fine positioning system (22) is formed as a functional unit with limited maximum force.

11. The cleaning device as claimed in claim 9 or 10, characterized in that the cleaning head (18) can be displaced by means of the fine positioning system (22) along at least one axis of movement (24, 26, 28) within a predetermined tolerance window.
12. The cleaning device as claimed in claim 11, characterized in that the tolerance window is defined by the maximum adjusting displacement of the fine positioning system (22) and/or by the geometry of the cleaning head (18).
13. The cleaning device as claimed in one of claims 9 to 12, characterized in that the fine positioning system (22) has for a number of directions of movement (24, 26, 28) of the cleaning head (18) that are relevant to component collision a respectively assigned fine positioning element (38, 40, 42) for predetermining the contact pressure specific to the direction of movement.
14. The cleaning device as claimed in claim 13, characterized in that the fine positioning element (38, 40, 42) has a telescopic adjusting mechanism.
15. The cleaning device as claimed in claim 13 or 14, characterized in that the fine positioning element (38, 40, 42) can be variably set with regard to its maximum adjusting force, while forming the contact pressure.
16. The cleaning device as claimed in one of claims 13 to 15, characterized in that the fine positioning element (38, 40, 42) has a pneumatic or hydraulic actuating unit.

17. The cleaning device as claimed in one of claims 9 to 16, characterized in that the cleaning head (18) is adjustable in its position by means of the fine positioning system (22) along three axes of movement (24, 26, 28) which are substantially orthogonal to one another.
18. The cleaning device as claimed in one of claims 9 to 17, characterized in that the cleaning head (18) can be moved rotatably about at least one axis of rotation (30, 32, 34).
19. The cleaning device as claimed in one of claims 13 to 18, characterized in that the cleaning head (18) has for at least one direction of movement (24, 26, 28) that is relevant to component contact a cleaning stop surface (44) with an associated fine positioning element (42).
20. The cleaning device as claimed in one of claims 9 to 19, characterized in that the cleaning head (18) is exchangeably fastened to the fine positioning system (22).
21. The cleaning device as claimed in one of claims 9 to 20, characterized in that it is formed as a manipulator device or as a robot (36).
22. The cleaning device as claimed in one of claims 9 to 21, characterized in that the rough positioning device (20) has a movable robot arm (46), fastened to the free end of which is the fine positioning system (22), which carries the cleaning head (18).
23. The cleaning device as claimed in claim 21 or 22, characterized in that it has a programmable open-loop and/or closed-loop control device for the at least partially

automated positioning of the cleaning head (18) and cleaning of the component (10).

24. The cleaning device as claimed in one of claims 9 to 23, characterized in that the cleaning head (18) has a three-dimensionally extending cleaning surface (48).
25. The cleaning device as claimed in one of claims 9 to 24, characterized in that the cleaning head (18) has at least one stop shoulder (50), which can be moved with its cleaning stop surface (44) frontally against a component edge (52), while forming the contact pressure.
26. The cleaning device as claimed in claim 24 or 25, characterized in that the cleaning surface (48) is formed in a substantially U-shaped or L-shaped manner.
27. The cleaning device as claimed in one of claims 24 to 26, characterized in that the cleaning surface (48) has at least one undercut (54), which can be brought into contiguous contact with a component surface (12).
28. The cleaning device as claimed in one of claims 9 to 27, characterized in that the cleaning head (18) is provided on its component contact side with at least one exchangeable cleaning element (56).
29. The cleaning device as claimed in claim 28, characterized in that the cleaning element (56) is a sponge and/or a brush element and/or a cloth, and in particular a microfiber cloth.
30. The cleaning device as claimed in one of claims 9 to 29, characterized in that it has a store for the intermediate

storage of at least one cleaning head (18) and/or at least one cleaning element (56).

31. The cleaning device as claimed in one of claims 9 to 30, characterized in that it has a cleaning-head and/or cleaning-element handling device.
32. The cleaning device as claimed in one of claims 9 to 31, characterized in that the component (10) is a component of a vehicle body with at least one surface (12) to be cleaned in a defined manner with regard to the contact pressure to be applied.